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Tulsa Tornado Tribune

"Where People Who Know The Weather Get Their Weather"

National Weather Service Tulsa, Oklahoma — Fall, 2004

Summer 2004 Much Cooler than Normal

If you thought the summer of 2004 was unusual, you were absolutely right. On many days this summer, the weather was more reminiscent of late September or even October than the usual dog days of July and August. Absent was the normal pattern of persistent high pressure leading to day after day of hot, humid afternoons and muggy nights, and little in the way of significant rains. Instead, the summer was characterized by frequent cold frontal passages, generous rainfall and unusually mild temperatures.

So mild were temperatures in fact, that Tulsa tied for its sixth coolest summer (June-August) of the last 100 years, and coolest since 1967. Fort Smith saw its seventh coolest summer on record, the coolest since 1992. None of the regular climate reporting stations in the area saw the temperature hit 100 degrees during the period; the last time this happened in Tulsa was 1997.

A couple of unseasonably strong cold frontal passages lead to numerous temperature and precipitation records across eastern Oklahoma,

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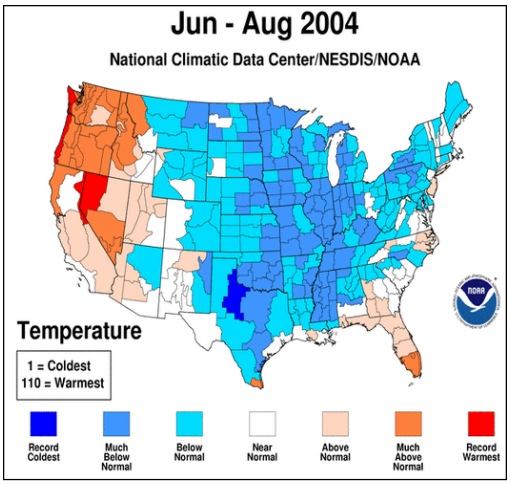

Oklahoma and Arkansas were not the only areas to see significantly below normal temperatures this summer.

Editor's Notes

The roller-coaster ride of 2004 precipitation continues, as October is off to a wet start. This follows a wet summer, bookended by very dry conditions in May and September, typically two of the wettest months of the year. We'll examine (and hopefully not beat to death) the trend in this edition.

Craig A. Sullivan - Editor

Inside this issue:

Floods Dampen July 4th Weekend

Strong thunderstorms moved through eastern Oklahoma and northwest Arkansas on July 2-3, producing torrential rainfall over much of the area. The heaviest rainfall totals were in a band from Muskogee, OK to Mansfield, AR, where 4 to 7 inches were common. Another small area of 3 to 5 inches fell across Delaware County in northeast Oklahoma and Benton County in northwest Arkansas. The heavy rains resulted in widespread flash flooding.

Especially hard hit was Benton County, Arkansas. High water closed numerous roads, including city streets in Siloam Springs, Highway 59 near Sulphur Springs and Highway 94 just north of Rogers. Extensive damage was done to county roads as well, with four bridges washed out. In addition to flooded roads, significant property damage occurred. Thirty people were evacuated from an apartment complex in Rogers. Also, a dike break caused significant flooding in the downtown area of Decatur. Countywide, the damage was estimated near one million dollars.

Areas in west central Arkansas were hard hit as well. In Sebastian County, numerous highways were flooded, including Highway 22 just south of Lavaca, Highway 255 near Central City and Highway 45 near Midland. Along Highway 96 between Fort Smith and Greenwood, two vehicles were swept off the road, but fortunately, the drivers escaped injury. In the city of Greenwood, at least 100 people were displaced from their

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Summer

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northwest and west central Arkansas in July. The first cold front affected northeast Oklahoma and northwest Arkansas on July 18. A second, stronger cold front surged south through all of eastern Oklahoma, as well as northwest and west central Arkansas on July 25. Cold air, thick clouds and rain persisted behind this front, leading to several notable daily temperature and precipitation records. Fayetteville, AR tied or broke record low maximums on five of the six days from the 25th to the 30th, with record overnight lows on the 27th and 28th. McAlester, OK broke record low daily average temperatures five consecutive days from the 25th to the 29th.

Monthly average temperatures for July turned out to be well below normal as a result. For Tulsa, the monthly average of 79.1 degrees was 4.4 degrees below normal, making this the eleventh coolest July on record. Similarly at Fort Smith, the monthly average of 79.1 degrees was 3.1 degrees below normal, good for the eighth coolest July.

Precipitation was well above normal in July, as both Tulsa and Fort Smith logged their eighth wettest July on record. The 8.63 inches of rain at Tulsa International Airport was 5.67 inches above normal, while the 7.26 inches at Fort Smith was 4.07 inches above normal.

The trend of regular frontal passages and much below normal temperatures continued into August. Both Tulsa and Fort Smith recorded their seventh coolest August on record. A number of days during the first half of the month saw temperatures from 10 to 15 degrees below normal.

While precipitation trends reversed during August (*see* **Dry Spell** *on page three*), as a whole, the summer was wetter than normal. For June through August, Tulsa recorded 16.66 inches of rainfall, making this the 14th wettest summer on record. Fort Smith did even better, checking in with its eighth wettest summer on record.

Mild Wet Summer = Cold Wet Winter?

The National Weather Service in Tulsa has determined a summer that is a milder and wetter than normal, as experienced this year, does not necessarily mean the following winter will also be colder and wetter than normal. Data from 1905 through 2004 were compiled and show that summer temperatures and precipitation are apparently not good predictors for temperatures the following winter.

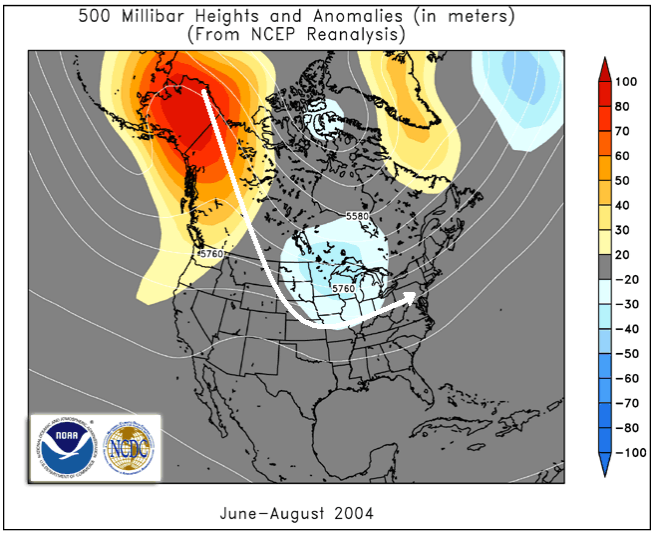
The 33 mildest summers (June - August) in Tulsa were identified, then checked against what happened during the following winters (December - February). Only 10 mild summers were followed by colder than normal winters. In 11 years, the following winters were warmer than normal, and 12 winters had normal temperatures.

Precipitation data was also examined. A wetter than normal summer in Tulsa was followed by a wetter than normal winter only a third of the time. Past data revealed that following a wetter than normal summer, 11 winters were also wetter than normal; 11 recorded normal precipitation; and 11 had below normal precipitation.

Similar results were found looking at temperature and precipitation data from Fort Smith.

Further information can be found at the web site of the Tulsa National Weather Service Office under the climate section.

Nicole Kempf - Meteorologist



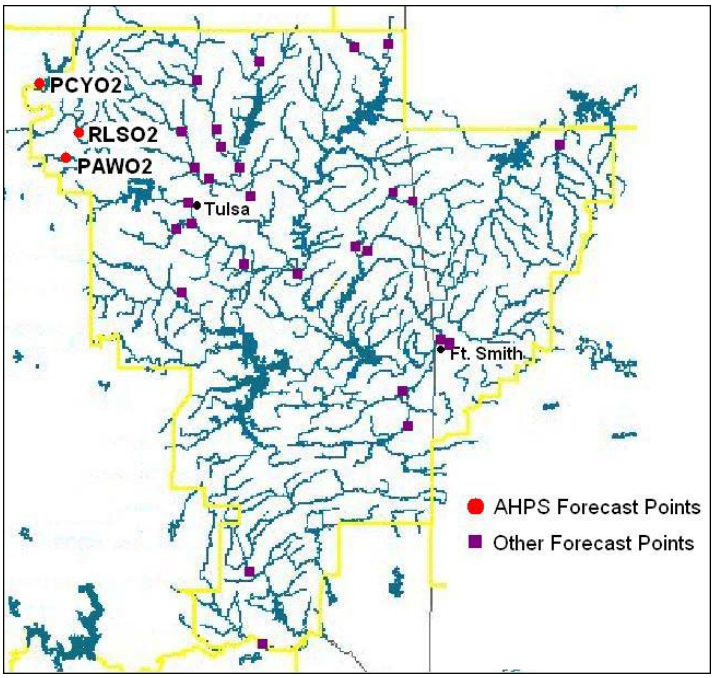
The Cause

Why was the weather so unusual this summer? The answer lies with the jet stream. Normally during the summer months, the jet stream resides over the northern latitudes, leaving most of the contiguous United States south of the storm track.

This summer however, an abnormal pattern persisted much of the time. As the map at the right illustrates, a large upper ridge dominated over the eastern Pacific and Alaska, while an unusually strong upper trough persisted over eastern Canada.

The result was the jet stream (bold white arrow) taking on a more northerly component, a pattern much more common in the cool season. A series of Canadian cold fronts moved into the central United States as a result, bringing below normal temperatures.

AHPS River Forecast Points in WFO Tulsa HSA



For a more detailed explanation showing how the new AHPS graphics are created by the Arkansas Basin River Forecast Center (ABRFC), please see the newsletter article at the following website:

www.srh.noaa.gov/abrfc/gage/Vol2.2/Summer2002.html

In late September, three river forecast points in the WFO Tulsa Hydrologic Service Area (HSA) were enhanced with new Advanced Hydrologic Prediction Service (AHPS) capabilities. The river forecast points are:

- Black Bear Creek at Pawnee (PAWO2)
- Arkansas River near Ralston (RLSO2)
- Arkansas River near Ponca City (PCYO2)

AHPS points will consist of at least a short-term hydrologic forecast in text and graphical format, graphical maps of the river gage location, river level impacts at critical heights, and long-term probabilities of flow, height, and volume. The addition of probabilistic forecasts will give the user more information to make a risk-based decision.

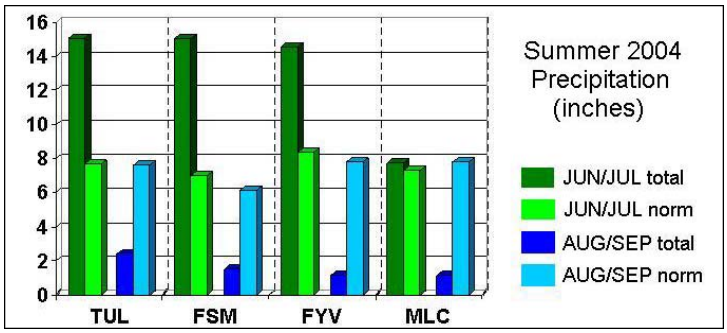
To see the new AHPS-enhanced forecasts, please go to the WFO Tulsa website and click on the link marked "Rivers & Lakes AHPS" in the left column. The three AHPS river forecast points are depicted with a circle icon.

Probabilistic forecasts are scheduled to be added to more forecast points in the Tulsa HSA over the next several years. For more information about AHPS, please go to www.srh.noaa.gov/ahps/about.htm.

Al Hong - Service Hydrologist

Dry Spell

On the heels of an unusually wet early summer period, a lack of rainfall over western Arkansas during the months of August and September lead to record dryness over much of the region. In Fayetteville, it was the second driest August and September on record, dating back to 1890. In Fort Smith, the two month period of August and September were the fourth driest on record. Across eastern Oklahoma, it was not as dry as western Arkansas. However, in Tulsa the same two month period was ranked as the 14th driest since 1888.



The above graph illustrates the difference in precipitation compared to normal between the early and late summer months for Tulsa, Ft. Smith, Fayetteville and McAlester.

While soil moisture is now very low across the region, a good representation of how the region is doing this year in terms of precipitation is where lake levels are currently. Across eastern Oklahoma, most lake levels were very close to seasonal normals as of October 1. Among the largest reservoirs, both Eufaula and Fort Gibson were at 100 percent normal capacity, while several others including Sardis, Tenkiller and Oologah were at greater than 90 percent. Beaver Lake in northwest Arkansas was above normal through July as a result of heavy rains during the late spring and early summer. As of October 1, the lake level remained near 100 percent of the conservation pool.

Our Secondary Severe Season

Severe thunderstorms are a phenomenon most often associated with spring, but as we all know, can occur just about any time of year in the south central United States. In fact, the frequency of severe weather increases in this part of the country during the autumn months, with a "secondary" severe season occurring from September through November.

At first glance, this makes a lot of sense, because the jet stream is in closer proximity to the area at this time of year, much like we see in the spring. Thus, more frequent weather systems and fronts move through the area and may serve as a catalyst for thunderstorms. However, a closer look shows that the frequency of severe weather in the fall is only slightly higher that in the summer or winter, and significantly less than the spring.

There are a couple of reasons why the fall severe season is less active than the spring. The first has to do with the seasonal change of temperatures at both the surface and at the upper levels of the atmosphere. In spring, the surface tends to heat up more quickly than the atmosphere above it, leading to a more unstable environment for thunderstorms to develop in. This results in stronger updrafts to produce severe weather. On the other hand, during the fall, the surface temperatures begin to cool more rapidly than the upper atmosphere, which tends to produce a more stable regime.

A second factor involves the jet stream, the narrow ribbon of strong winds in the upper atmosphere which serve as the steering current for weather systems. The jet stream is driven by the temperature difference between the tropical and the polar latitudes; the greater the temperature difference the stronger the jet, and vice-versa. A more specific look at severe weather data suggests that there is more of a peak in tornadoes versus damaging wind or large hail events in the fall. This can likely be attributed to a stronger jet stream than what is typically observed in the summer.

This damage was part of a memorable fall severe weather outbreak that produced three tornadoes in Franklin County, Arkansas November 23, 2001.

However, the temperature contrast is greater in the spring, as it takes longer for the northern latitudes to warm up than the tropical regions. Thus, we see a stronger jet in the spring. As the fall begins, the temperature contrast is at its weakest, and the jet tends to be a little weaker. While the contrast becomes great by late fall leading to a strong jet stream, by that time the days are much shorter than we see in the spring and intrusions of cold air become more common.

Still, there have been several notable outbreaks of severe weather, including tornadoes, in the fall. On November 23, 2001, a series of tornadoes hit Franklin County, Arkansas, damaging several structures near the town of Altus. Just last year, on November 18, a severe storm produced baseball sized hail in the Tulsa area, causing an estimated 20 million dollars in damage.

Please report the following conditions to the NWS Tulsa

1-800-722-2778

- Tornadoes
- Funnel Clouds
- Rotating Wall Clouds
- Hail - penny size (3/4") or larger
- Wind Gusts > 50 mph (estimated/measured)
- Flooding
- Any weather related damage
- Any life-threatening event

NOTE: Do NOT report heavy rain or lightning

Thank You!

HWO Revised

You may have noticed a change in the format of the Hazardous Weather Outlook (HWO) recently. Several weeks ago, the NWS in Tulsa began issuing the HWO using the new format, which includes more specific details on types of hazardous weather; tornadoes, severe thunderstorms, flash floods, heavy rain, dense fog, significant non-thunderstorm winds, and fire danger.

Each of the weather conditions will be assigned a risk category for the first 24 hours; none, limited, elevated, or significant. In addition, more specific references will be made to area affected and onset time of the event. If the risk of any particular weather is deemed elevated or significant, the area at greatest risk will be outlined to further refine the risk area.

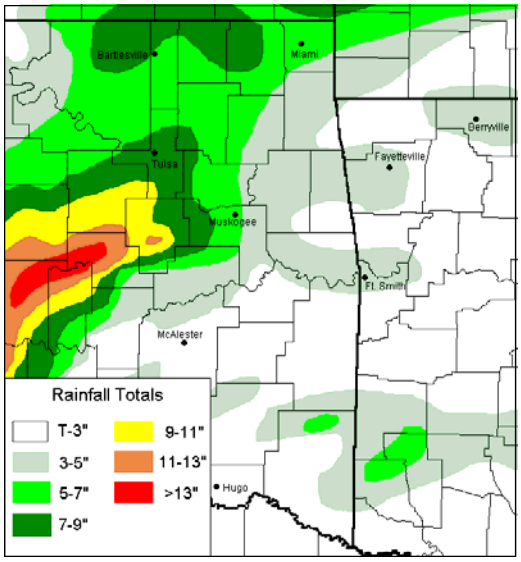
Weather History : Hurricane Impacts

Hurricanes have been very much in the news lately, as the 2004 Atlantic season has been a very active one. Four hurricanes made landfall in Florida this year, causing millions in property damage and numerous deaths and injuries. With so many tropical systems making landfall in the United States this year, you may be left wondering, is it possible for a hurricane to affect regions such as Oklahoma and Arkansas? Not only is it possible, but has happened in the past, mainly in the form of torrential rain.

Fortunately, Oklahoma and Arkansas lie just far enough inland from the Gulf Coast to spare us the damaging winds associated with hurricanes and tropical storms. Even the most powerful hurricane moving up from the Gulf would most likely weaken below tropical storm strength (maximum sustained winds of 40-73 mph) before reaching this far north. In fact, the last time a storm produced tropical storm force winds in Oklahoma was Tropical Storm Carla in 1961, which had made landfall along the Texas Gulf Coast as a category 4 hurricane.

The other thing tropical systems contain is tremendous amounts of moisture, and they are often slow moving. The result of this would be very heavy rainfall over a large area and a long period of time. One example of this occurred with Hurricane Elena in September, 1985. After making landfall near Biloxi, Mississippi as a destructive Category 3 storm, the remnants tracked to the northwest, with the center of the tropical depression passing through western Arkansas. The storm caused considerable flooding across central Arkansas, mostly to the east of Tulsa's CWA.

In addition, Pacific hurricanes can affect the weather in the southern plains as well. The remnants of such systems may become entrained in the upper flow, and like their Atlantic counterparts, produce tremendous rainfall amounts. From October 17-23, 1983, the remnants of Hurricane Tico moved northeast from Mexico across the southern plains, producing a swath of torrential rains from southwest through central and northeast Oklahoma. The heaviest totals were just to the south of the Oklahoma City area, where 15 to 17 inches fell. Much of northeast Oklahoma received from 5 to 7 inches, with 8 to 10 inches common in an area southwest of Tulsa. A small portion of northwest and west central Arkansas, including Fort Smith, received up to 4 inches.



Storm-total rainfall map for the period October 17-23, 1983, associated with the remnants of Hurricane Tico.

Although some flash flooding and extensive property damage occurred, widespread river flooding was likely alleviated by summer-long drought conditions, which left most reservoirs well below normal levels.

Sometimes, an Atlantic hurricane making landfall to our southeast can have quite the opposite effect, as we have seen a few times this season. An easterly low level circulation can set up across the southern plains, advecting dry and stable low level air into the region and effectively cutting off low level moisture return. Sometimes this can persist for several days, leading to a prolonged stretch of dry weather.

FY '04 Warning Verification

The National Weather Service in Tulsa continues to strive toward improved warning of severe weather events. During the fiscal year 2004 (Oct. 1– Sep. 30), NWS Tulsa issued 617 severe thunderstorm and tornado warnings. At the right are Probability of Detection (POD) and average lead time statistics for the past year. The 95.6% POD on severe thunderstorm and tornado warnings was the highest ever by this office!

FY 2004 Statistics	POD	Lead Time
Severe Thunderstorm + Tornado	95.6%	21 min.
Tornado	90%	19 min.
Flash Flood	94%	68 min.

Winter Outlook Issued

The National Oceanic and Atmospheric Administration (NOAA) has issued its 2004-2005 Winter Outlook. Specifically for eastern Oklahoma and western Arkansas, the outlook calls for a better than even chance that winter precipitation will be above normal. Meanwhile, the temperature outlook for the area is less clear, giving equal chances of below, near or above normal temperatures.

Recent observations indicate a weak to moderate El Niño event is underway in the central equatorial Pacific Ocean, and is expected to persist through early 2005. NOAA scientists do not expect this El Niño to reach the strength of the1997-1998 El Niño event.

More details on the winter outlook and El Niño impacts can be found at NOAA's website: **www.noaa.gov**. The outlook will be updated on October 21.

Thank You!

To all the people in all the agencies that have helped the Tulsa office and me over the past four years, I just want to say thank you!

I've just left my job as the Warning Coordination Meteorologist (WCM) with the Tulsa NWS office and have started work as the Meteorologist in Charge (MIC) at the Morristown, TN (eastern Tennessee) NWS office. (Just when you got me trained, huh!)

It's really tough to leave such a great office and great people in Oklahoma and Arkansas with whom I've worked so closely. I'll just have to trust that it's the right thing to do!

THANKS to those of you who helped make my job and life in Tulsa easier and more meaningful!

If you wish to get in touch with me (any parting shots?!?), my e-mail address will be the same -- george.mathews@noaa.gov Thanks again and take care!

George Mathews - Meteorologist-in-Charge
WFO Morristown, Tennessee

Ed Calienese has been selected as the new Warning Coordination Meteorologist at WFO Tulsa. Ed has previously served as the WCM at the Lubbock, Texas office and is a licensed HAM radio operator. Ed is expected to arrive in Tulsa around the end of October.

Floods

(Continued from page 1)

homes. In nearby Crawford County, city streets flooded in Van Buren, along with numerous county roads. Between Uniontown and Figure Five, a double-wide mobile home was washed away by flood waters.

Much of eastern Oklahoma received significant flood damage as well. In Delaware County, a family camping near Spavinaw Creek had to be rescued when water from Lake Eucha overflowed the spillway and flooded their campsite. Numerous county roads were flooded in Cherokee and Adair Counties as well.

Extensive flash flooding occurred in Sequoyah and Muskogee Counties. Several businesses suffered flood damage in the town of Vian, and a handful of homes were flooded in Sallisaw. Widespread flooding of roads was reported in both counties. Highway 64 was closed in several locations in Sequoyah County, and near the town of Keefton in Muskogee County. City street flooding was also reported in the cities of Muskogee and Stigler. In all, over three-quarters of a million dollars in damage were reported in Oklahoma.

Heaviest 24 hour rainfall totals from July 2-3, 2004:

5 NE Spiro, OK	8.18
Midland, AR	7.34
Sallisaw, OK	6.23
Webbers Falls, OK	5.98
Lavaca, AR	5.40
Spiro, OK	5.32
Maysville, AR	5.07
Rudy, AR	4.97
Bentonville, AR	4.90

The heavy rains produced significant runoff into rivers and streams in the lower Arkansas River basin. River flood warnings were issued for the Illinois River near Watts and Tahlequah, OK, Flint Creek near Kansas, OK, the Poteau River near Panama, OK, and the Arkansas River and Lee Creek near Van Buren, AR. Moderate flooding occurred along the Illinois and Poteau Rivers, with minor flooding reported elsewhere.

Because the flooding occurred during the July 4th weekend, it was especially devastating to businesses that depend on tourism along the scenic Illinois River, a popular floating destination. Normally, about ten thousand customers are expected to float the river during the holiday weekend.

Mark Abbas - Meteorologist
Al Hong - Service Hydrologist